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YAWS IN BRAZIL

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General Aspects of the Problem

Historical background

The first Indians (Tupiniquins) seen by the discoverers of Brazil did not suffer, apparently, from any disease similar to what was then called in Iberia " boubas " or " bubas ". Péro Vaz de Caminha, scribe of Pedro Alvares Cabral's Portuguese Armada, thus described them : " The skins are somewhat brown, tending to red . . . Their bodies are so clean-limbed and sturdy, and they are as handsome as could be . . . They look better and healthier than we do . . . " [9, a]

Nevertheless, from the year 1558 onwards, travellers and writers in different periods have referred to the disease (yaws) as spreading among the Indians of Rio de Janeiro, Bahía, and Maranhão. The author of *Tratado descritivo do Brasil em 1587* (a manuscript of approximately the end of the 16th century) described the occurrence of yaws among the Tupinambas, near relations and neighbours of the Tupiniquins : " Yaws is very frequent among the Tupinambas who give it to one another, particularly when they are children . . . " [22, b]

Those Indians who still live in the hinterland of the country under primitive conditions are, however, free from the disease.

The first African slaves were brought to Brazil by adventurers and colonists from Portugal. After 1538, however, they were sent to Brazil direct from Africa. Yaws was possibly brought to the New World by these slaves, for it is believed that yaws has existed in Africa since the beginning of time, and in the 17th-, 18th-, and 19th-century slave ships epidemics spread easily during the long journey. The sugar-cane zones of Brazil to which the imported negroes were sent are still today foci of yaws, the slaves' descendants being the disease's most frequent victims. [2, 3]

Geographical distribution

Although yaws is found in almost every State of Brazil, in the southern region it does not constitute a major health problem. Complete data

a " A feição dêles é serem pardos, maneira de avermelhados . . . Seus corpos são tão limpos, tão gordos e tão formosos, que não podiam mais ser... Andam tais e tão ríjos e tão nédios que o não somos nós tanto..."

b "São os Tupinambas muito sujeitos à doença das boubas que se pégam uns aos outros, mormente enquanto são meninos... "

on the incidence of the disease in the country are still not available, but on the basis of information from the municipal "hygiene posts", the reports of doctors working in the hinterland, the reports of the specialized services, and the conclusions of the Annual Meeting of Brazilian Dermatologists and Syphilologists, held in Recife, Pernambuco, in September 1949, it is estimated that there are about 350,000 cases in the whole of Brazil—a country with a population of 52,000,000 (1950). The regions with the highest incidence are north, north-east, and east Brazil (see fig. 1).

FIG. 1. DISTRIBUTION OF YAWS

The dotted lines on this map and on the rainfall map (fig. 3) represent the boundaries of the geographical regions : north, north-east, east, south, and west-central (reading from the left, clockwise).

Environmental factors related to incidence

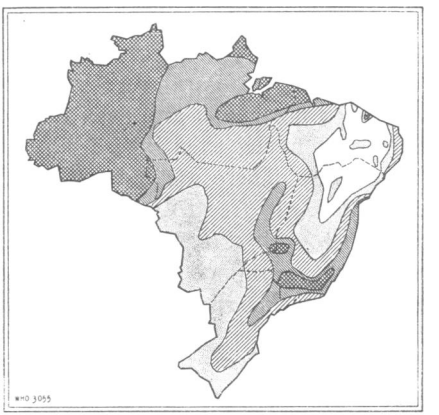
On account of its vast geographical expanse—8,516,000 km² (approximately 3,300,000 square miles)—which corresponds to almost half of South America, Brazil presents great variations of climate, having hot, temperate, and cold regions; however, for the most part, it lies within equatorial and tropical zones.[8] (See fig. 2 and 3 for the zones of vegetation and rainfall in Brazil.)

Yaws generally exists in zones of a medium monthly temperature (around 20°-25°C (68°-77°F)) but with a relatively high degree of humidity (80%-85%) and medium or high monthly rainfall (60-200 mm (2½-8 inches)). The rains and the humidity are most important factors in yaws epidemiology. In certain areas of the north-east,[19] notwithstanding the lower temperature (less than 20°C (68°F)), the disease is more prevalent

FIG. 2. ZONES OF VEGETATION

Equatorial forest
Tropical forest
Savanna
Araucaria forest, and fields
Prairie
" Campinas "

FIG. 3. RAINFALL ZONES



above 2,000 mm
1,800 - 2,000 mm
1,500 - 1,800 mm
1,000 - 1,500 mm
below 1,000 mm

in the mountains, where the rainfall and the humidity are higher. Not only in the country as a whole, but particularly in the local foci, yaws is most prevalent in the equatorial and tropical forest and the savanna zones. In all foci, the agricultural labourers are, in general, the most prone to develop the disease, but in the north-east and the east, it is in the sugar-cane areas that the population suffers most. Frequently the disease invades the suburbs of large towns, as happened in the City of Rio de Janeiro twelve years ago.[20]

It is important to note that within the large endemic areas there exist zones free from the disease, and zones with a high, medium, or low degree of morbidity.

In Amazonas, on account of its very sparse and scattered rural populations, the natural spread of the disease is retarded. On the other hand, climatic conditions favourable to the development of yaws are found in the whole northern area. As a result, except in small towns, large numbers of cases are seldom found grouped together, although morbidity figures are high in this vast region of 3,500,000 km² (approximately 1,350,000 square miles) with a population of less than 2,000,000. Along the rivers and their tributaries, and as far as civilization has extended, yaws occurs. In 1929, in the hospitals of Manaós on the Amazon river, 600 persons suffering from yaws came from nearby neighbourhoods for treatment.[10]

In 1940, in the course of a malaria survey, cases of the disease were found in Amazonas along the Madeira, Purús, and Juruá rivers.

During May to October 1946, a census taken in the municipality of Breves (State of Pará) revealed 1,643 cases of yaws.[7]

In the north-east and east, where the population is more concentrated, numerous nuclei exist where 5%, 10%, or 15% of the population suffer from yaws. There are, nevertheless, large areas which, although densely populated, are free from the disease, because they do not present conditions favourable for its dissemination. Of the 235,770 persons in the north-east examined by the Sanitary Organization Division from 1945 to 1950, 19,062 (8.1%) had yaws lesions.[4] A number of examples may be cited : In the State of Pernambuco, yaws exists in at least 46 municipalities.[17] In 1929-30, 4,690 cases of yaws were treated in a single "health centre " of the State of Ceará.[1] In the State of Paraíba, perhaps the most infected in Brazil, out of 9,146 persons seen in only two localities in the municipality of Serraria, 12.7% had yaws.[5] On the other hand, in the east, in the municipality of Teófilo Otôni in the State of Minas Gerais, 25,186 cases were treated from 1934 to 1941.[18]

Generally speaking, in the zones where yaws exists in Brazil the small fly, *Hippelates*, of the order Diptera and of the family Chloropidae, is abundant. The yaws patients believe that these flies transmit the disease, and the observations of several authors support this view.[11, 15, 16, 21]

Whereas yaws may be contracted at any age, its greatest incidence occurs in the 9-20 years' age-group. Negroes and mulattoes always represent about 70% of the total number of cases. The disease generally occurs among the poorer populations, where the standard of living is low, and conditions of hygiene are poor.

Clinical and Epidemiological Studies of a Focus of Yaws in the Eastern Region of Brazil

The various foci of yaws in Brazil show very little clinical or epidemiological variation. The following data on a focus of yaws studied in Baixada Fluminense (State of Rio de Janeiro) are, therefore, of general interest.

This focus comprises an area of approximately 1,800 km² (700 square miles), with a population of about 100,000. The region is situated on the Atlantic coast at a little above sea-level, and consists of lowlands, hills and mountains (100-800 metres (350-2,650 feet) high), and lagoons which are peculiar to the region. The climate is changeable and there are only two distinct seasons. The rains fall from October to April, with a monthly average of from 80 to 120 mm (3-5 inches). This is also the hot season, with a monthly average temperature of from 22°C to 25°C

(71°-77°F). During the rest of the year the rainfall varies from 44 to 66 mm (1½-2½ inches), and the medium monthly temperature from 20°C to 22°C (68°-71°F). The relative humidity is always high during the whole year, varying from 80%-83% in the dry season to 83%-85% in the rainy season (data from the Meteorological Service, Ministry of Agriculture, Brazil). Forest and savanna predominate. The mountains are always covered with rank vegetation, and present lower temperatures and higher rainfall and humidity. This region is now beginning to be industrialized, but in the rural zones where yaws occurs primitive agriculture and cattle-raising predominate. As a rule, the field labourers serve the owners of the lands or of the farms. Practically the only organized work is in the cultivation of sugar-cane and, on a small scale, of bananas. As a result of erosion, the lands are no longer suitable for coffee plantations. The population is composed of " whites ", negroes, and mulattoes. Their capacity for work is lessened by poor nourishment and by endemic diseases, such as ankylostomiasis, tropical ulcer, and yaws. Until very recently malaria was the most serious sanitary problem, but now, thanks to prophylaxis and mosquito control, it has been practically eradicated.

Yaws occurs sporadically throughout this focus, as in all other foci in the national territory. Small free areas alternate with others of high, medium, or low endemicity. The disease occurs not only in the lowlands, but also on the mountain slopes where it is frequently very prevalent. In the towns yaws exists only in the suburbs.

The records of the Yaws Study Centre, established in 1945, are kept in such a way that each individual's card can be readily found by any helper who has received previous training. This card-index makes possible the quick and easy computation of data on hundreds or even thousands of patients. Data from 1,086 cases of yaws treated at the Centre are given in table I. A description of the general clinical evolution of the disease in this focus has been published previously.[14]

Table I shows that until the age of 8 years the incidence of yaws is practically the same in both sexes, but that between the ages of 8 and 20 it occurs more frequently in males than in females. After the age of 20, again little difference in incidence is noted between the sexes. The explanation is that the boys play in the open air and soon go to work in the fields, where they are subject to frequent trauma. As to racial differences, the " whites " represent only about 30% of the cases, the other 70% occurring among the negroes or mulattoes, who represent the lowest economic class of the population.

Table I also shows that of the 239 initial lesions (66% were on the legs and feet),[14] 143 (60%) were found in persons under 15 years of age, and 195 (82%) in persons under 21. More than 70% of the patients are suffering from the infectious stages of the disease (primary and secondary phases, isolated or associated). The incidence of each type of yaws lesion

TABLE I. CLINICAL AND EPIDEMIOLOGICAL DATA, ARRANGED BY AGE-GROUPS, FROM 1,086 YAWS PATIENTS TREATED AT THE YAWS STUDIES CENTRE (STATE OF RIO DE JANEIRO)

Data	Age-groups (years)							Total	%
	under 1	1-3	4-8	9-14	15-20	21-30	31 and over		
Sex :									
males	3	23	95	208	158	62	122	671	61.8
females	3	27	74	88	90	58	75	415	38.2
Race :									
negroes	4	21	92	138	124	70	85	534	49.2
mulattoes	1	11	26	70	52	19	46	225	20.7
" whites "	1	18	51	88	72	31	66	327	30.1
Phase :									
primary	1	2	11	11	10	2	3	40	3.7
primo-secondary	4	23	38	53	42	16	23	199	18.3
secondary	1	25	115	208	109	38	37	533	49.0
tertiary	0	0	5	24	87	64	134	314	28.9
Yaws lesions :									
initial lesion	5	25	49	64	52	18	26	239	22.0
framboesioma	4	45	123	198	111	48	54	583	53.7
framboesides	3	26	71	126	91	47	68	432	39.8
hyperkeratosis, plantar	0	16	83	190	167	88	146	690	63.5
bone lesions	0	2	12	18	24	17	23	96	8.8
gummas and ulcers	0	0	5	10	21	22	37	95	8.7
gangosa	0	0	0	2	3	3	2	10	0.9
juxta-articular nodules	0	0	0	0	2	4	15	21	1.9
General symptoms :									
adenitis	4	40	122	192	131	59	96	644	59.3
rheumatoid pains	0	10	78	146	143	89	141	607	55.9
headache	0	5	47	93	94	54	110	403	37.1
without the above symptoms	2	8	24	17	33	17	25	126	11.6

recorded on the card, and the presence or absence of general symptoms (adenitis, rheumatoid pains, and headache), are also evaluated separately in table I.

As to the palmo-plantar hyperkeratosis, the lesions of the hands are certainly less numerous than those of the feet, which showed lesions in 63.5% of the cases. When the frequent occurrence of the initial lesions, and of the framboesioma, on the feet is taken into consideration together with the small number of tertiary lesions in the same place, it is found that more than 70% of the patients have difficulty in walking and in working in the fields. Walking and, principally, working barefoot in bad soil contributes to the common localization of yaws lesions to the feet. The predominance of the initial lesions on the inferior extremities results from the frequent skin abrasions (" portal of entry ") caused by accidents when playing and/or working in the fields.

Yaws-Prevention Services in Brazil

Brazil still does not possess a special service with a national programme for combating yaws. Responsibility for its control belongs to the Sanitary Organization Division of the National Department of Health, Ministry of Education and Health. This Division maintains services in the north-east (States of Ceará, Pernambuco, Paraíba, and Alagoas), and in the east (States of Minas Gerais and Espírito Santo). In 1952 work will be started in the north (municipality of Breves, State of Pará). The work of the Sanitary Organization Division consists chiefly in creating " rapid-treatment centres " (providing hospitalization) or " posts " in the affected rural zones, according to their economic and social influence. There is no standardized treatment, although penicillin is now the drug usually employed. Generally, the chief doctor of the centre or post stipulates the method of treatment. About 20,000 persons were treated in 1950 at the north-eastern posts alone.[4]

The State governments, too, through their hygiene posts in the hinterland, help the diseased, although their aim is not the prophylaxis of illness but the cure of the patient himself.

Consideration of Anti-Yaws Campaigns: Penicillin Therapy and Organization of Treatment

The treatment scheme which gave satisfactory results, and which was adopted by us at the Yaws Study Centre, was that of placing the new patient in a treatment colony associated with the Centre and keeping him there in order to ensure that he obtained adequate therapy. At the same time, areas from which the cases came were kept under constant

surveillance until no new cases or relapses occurred and the area could be declared " clean ".

In five years, 1,086 patients were treated; we obtained 93% clinical cures, and 70% serological reversions in primary and secondary yaws. The serological reactions are shown in table II. The treatment lasted 10 days, two injections of 10,000-15,000 units of penicillin being given daily. The total dosage for the treatment of early yaws varied from 100,000 to 300,000 units, according to the age-group.

TABLE II. REACTIONS TO WASSERMANN TEST AFTER TREATMENT IN 772 CASES OF PRIMARY AND SECONDARY YAWS

Reactions	Number	%
Total	568	73.6
Positive *	169	29.8
Negative	399	70.2

* 55 (or 32.5% of the positive reactions) were only weakly positive (++).

The patients with infectious lesions (primary and secondary lesions) were given preference in placing in the treatment colony because of the high contagiousness of their lesions.

At present the infection is in a " residual " state in this focus.

The misconception that yaws is a disease of benign nature has contributed to the delay in the establishment of direct control measures against the disease. It may be preferable not to treat cases of this disease at all rather than to treat them inadequately, as such inadequate treatment interferes with the establishment of immunity.[12] The treatment of yaws deserves the same attention as that of syphilis. A complete treatment can only be administered under hospital conditions, since in the field, in ambulatory treatment, patients rarely attend for more than three injections. There are two reasons for this falling-off in attendance : (1) the patients' homes are usually rather far away from the hygiene posts, and this makes visits difficult; and (2) after the first injection their lesions disappear and they think they are cured.

It is recognized that the provision of ambulatory treatment by the hygiene posts is a hard task. The rural zones are inhospitable and difficult of access, and means of communication are scarce; these factors, combined with poor co-operation from the inhabitants, who lack sanitary education, make difficult a work which seems to be easy when planned. For example, when a treatment schedule of six injections with Mapharsen was instituted in 1946 in Amazonas by the Special Service of Public Health (Serviço

Especial de Saúde Pública (SESP)), the disappointing response shown in table III was obtained at a subpost in Breves (State of Pará).

TABLE III. ATTENDANCE OF YAWS PATIENTS FOLLOWING A COURSE OF TREATMENT WITH MAPHARSEN AT A "SUBPOST" IN BREVES (STATE OF PARÁ)

Injections	Patients	
	Number	%
1st	157	100.0
2nd	98	62.4
3rd	67	42.7
4th	40	25.5
5th	30	19.1
6th	11	7.0

To overcome these obstacles the system of "lodging" has been adopted. At the same time, temporary improvement in the patient's nutrition and the building-up of the patient's haemoglobin are attempted. Agents attached to the Centre, and chosen from local men trained in the diagnosis of yaws, make regular house-to-house visits to discover new yaws cases, and then send them by truck to the Centre for treatment. The patients are housed in large wooden barracks, annexed to the Centre. The rural teachers give voluntary and extremely valuable help during the campaign, and assist in discovering new cases through contacting the families of their pupils.

There is one problem of a social nature that must be considered, namely, the complete disorganization of the economy of families as a consequence of the interruption of work of their chiefs or of their subsidiary contributors (wives, and sons over 10 years of age). This is one of the principal causes of lack of co-operation from the patients. We have overcome the difficulty by the introduction near the Centre of small-scale cultivation of the pulse, fruits, and cereal grasses used in the nourishment of the patients themselves. On the third or fourth day after treatment, the patients, in spite of having incompletely healed lesions on the soles of their feet, can take part in the work and receive remuneration that compensates for the loss of their salaries during the "lodging" period.

This method is undoubtedly expensive, since penicillin is not a cheap drug and the "lodging" is costly. But in view of the fact that, at least in the last 20 years, hundreds of hygiene posts in Brazil have fought yaws with a minimum of practical results to the communities involved, as is shown by the continuance of old foci and the appearance of new ones

in the neighbourhood, we would not be justified in hesitating—simply because of the expense involved—to adopt a method that guarantees adequate results.

In large countries like Brazil, yaws control seems to be more conveniently undertaken by sectors, taking advantage of the natural limits of the foci in the areas of endemicity. In our opinion it is not advisable to attack all foci of the disease in the country at the same time, because this would require the expenditure of huge sums of money and the employment of large numbers of experienced personnel. By working in steps, taking one sector after another, the experience acquired and the personnel trained in one area can be subsequently employed in the other areas.

A single injection, or a very restricted number of injections given irregularly, is not enough for the prevention of yaws. In this manner, the years will pass without any noticeable decrease in the incidence of the disease. If and when such a decrease is observed, or when the disease almost disappears from a focus, this is usually a consequence of epidemiological changes due to urban expansion—as happened in the City of Salvador (State of Bahía)—or to the establishment of mass immunity among the populations not subjected to immigration, where the number of immune persons increases year by year.[13]

In spite of the fact that yaws control has been based on therapeutics —and this was so even before the antibiotic era—up to the present time all preventive campaigns have had little or no success. All those familiar with this subject are unanimous in stating that yaws is a disease offering great difficulties in its control. Even when a census has been taken some time after the treatment has been administered, new cases of the disease have been found to have occurred in spite of the apparent elimination of the source of infection. The principal factors responsible for this recontamination, according to Turner, Saunders & Johnston [23] and others, are the following : (*a*) individuals in whom the disease was still in the incubation stage at the time the census was taken; (*b*) latent cases judged as healthy, or individuals with atypical yaws lesions thought to be manifestations of some other disease; (*c*) the arrival of sick persons from neighbouring contaminated areas; (*d*) cases overlooked in the census; and (*e*) relapses due to inadequate treatment. The last factor is the most important one. It has been the main cause of the failure of many anti-yaws campaigns. For this reason it is of the utmost importance to maintain constant vigilance in order to eliminate cases caused by the above-mentioned factors.

The advisability of eradicating yaws is still subject to speculation. It is true that, in rural zones affected by yaws, syphilis is rare, the former disease seeming to prevent the dissemination of the latter. This is the principal reason for Blacklock's misgivings that eradication of yaws would result in serious rural outbreaks of syphilis.[6] However, to abandon anti-

yaws programmes and campaigns simply on the strength of such a hypothesis would not be justified, because the complete eradication of the disease will not be effected by yaws-control measures alone but will be achieved only when the poor conditions under which the afflicted populations live are raised to a " civilized " level. Furthermore, if it is admitted that yaws is a factor adversely affecting the productive capacity of labouring communities, it is logical that an attempt should be made to combat the disease in order to maintain it in a " residual " state.

SUMMARY

The development and extent of the yaws problem in Brazil is first outlined by the author. Yaws was probably introduced into Brazil by Africans shipped in the 17th, 18th, and 19th centuries as slave labour to the Brazilian sugar-cane plantations. While the disease has now spread throughout the country, with an estimated total number of cases of 350,000, the incidence of the disease is highest in the north, north-east, and east, and in the equatorial and tropical forest and the savanna zones. In the north, in spite of a scattered and largely rural population, the disease has spread as a result of favourable climatic conditions. In the north-east and east, where the population is denser, nuclei of high morbidity alternate with areas entirely free from the disease.

Measures of yaws control in Brazil are then described. Responsibility for control measures rests with the Sanitary Organization Division of the National Department of Health, Ministry of Health and Education, which maintains " rapid-treatment centres " and " posts " in the north-east and east. (During 1952, activity is to be extended to the north.) Treatment is not standardized, although penicillin therapy is now normal. The " hygiene posts " established in the hinterland of the country by the State governments also treat yaws patients.

A Yaws Study Centre has been established in the State of Rio de Janeiro, in an area which is a typical focus of yaws. The records of the 1,086 cases treated at this

RÉSUMÉ

L'auteur esquisse, pour commencer, les grandes lignes du problème du pian au Brésil. La maladie fut probablement introduite par des transports d'esclaves et de main-d'œuvre venant d'Afrique pour travailler dans les plantations de canne à sucre, au XVII^{e}, XVIII^{e} et XIX^{e} siècles. Le pian s'est répandu dans l'ensemble du pays, où l'on estime à 350.000 le nombre de cas; mais les régions les plus atteintes sont celles du nord, du nord-est et de l'est, ainsi que les zones de forêts et de savanes tropicales et équatoriales. Au nord, bien que la population, essentiellement rurale, soit dispersée, la maladie s'est propagée grâce à des conditions climatiques favorables. Au nord-est et à l'est, où la population est plus dense, des « taches » où la morbidité est élevée alternent avec des régions indemnes.

Les mesures de lutte antipianique au Brésil sont ensuite décrites. La Division des Services sanitaires du Département national de la Santé (Ministère de la Santé et de l'Education) est chargée des mesures de lutte. Cette division entretient des centres de traitement rapide et des « postes » dans les régions du nord-est et de l'est. (Au cours de 1952, cette activité s'est étendue aux régions septentrionales.) Le traitement n'est pas standardisé, bien que la pénicillinothérapie soit couramment appliquée. Les « postes sanitaires » établis dans l'arrière-pays par les gouvernements des Etats traitent aussi les pianiques.

Un centre d'étude du pian a été installé dans l'Etat de Rio de Janeiro dans une région qui est un foyer typique de pian. Les résultats obtenus sur les 1.086 cas traités

centre between 1945 and 1950 are assessed in illustration of the epidemiology of yaws in all Brazilian foci.

The provision of ambulatory treatment by the hygiene posts, etc., has never been very successful, partly because of difficulties of communication, but largely because of lack of co-operation from the patients, who are rarely prepared to make the number of visits necessary for a complete cure. By providing accommodation during a ten-day course of penicillin treatment, and remunerative work in the fields for the patients as soon as they were sufficiently well to undertake it, in five years the Yaws Study Centre obtained 93% clinical cures and reduced yaws infection in the area to a " residual " state.

Although the development of such treatment colonies is expensive, the author suggests that it is the only possible way of combating the problem of yaws in Brazil. The main cause of failure in anti-yaws campaigns in the past has been relapses due to inadequate treatment. By taking the Brazilian yaws foci sector by sector, and by maintaining the constant watch which is possible only when treatment colonies are established, yaws infection could at least be reduced to a " residual " state. The complete eradication of yaws will be achieved only when the poor conditions under which the afflicted populations live are raised to a " civilized " level.

de 1945-50 sont résumés dans l'article et illustrent les caractères épidémiologiques du pian dans tous les foyers du Brésil.

Le traitement ambulatoire dans les postes sanitaires et autres centres similaires n'a pas donné de résultats bien favorables, en partie à cause des difficultés de communication, mais surtout en raison de l'inertie des malades, qui ne s'astreignent guère au nombre de visites nécessaire à une cure complète. En assurant aux malades une hospitalisation de dix jours, durée du traitement à la pénicilline, en leur assurant en outre un travail agricole bien rémunéré lorsqu'ils seront en assez bonne santé pour l'entreprendre, le Centre d'étude du pian a obtenu en 5 ans 93% de guérisons cliniques et réduit l'infection pianique à un stade « résiduel ».

Ces centres de traitement sont certes coûteux, mais de l'avis de l'auteur, ils représentent le seul moyen pratique de combattre le pian au Brésil. Les échecs des campagnes antipianiques antérieures ont été dus aux rechutes, survenues à la suite de traitements insuffisants. En traitant les foyers de pian, secteur par secteur, et en maintenant une surveillance constante — ce qui n'est possible que si des « colonies de traitement » sont établies — il serait possible de réduire l'infection à un stade résiduel. Le pian ne disparaîtra complètement qu'avec l'amélioration des conditions de vie des populations affectées par la maladie.

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